What Is Claimed Is:

1. Apparatus for generating a mask having a nanoscale pattern, the apparatus comprising:

a container having a top portion and a bottom portion, at least one sidewall between the top portion and the bottom portion, and an enclosed area formed by the top portion, the bottom portion and the at least one sidewall;

a supporting liquid disposed within the container, the supporting liquid forming a top surface at a first given height between the bottom portion and top portion of the container, and the supporting liquid having a first given density;

a substrate positionable within the container at a second given height from the bottom portion thereof, the substrate having a top surface disposed toward the top portion of the container;

a suspension comprising a suspension fluid having a plurality of particles suspended therein, the suspension being selectively deliverable to the enclosed area within the container, the suspension of

the plurality of particles having a second given density, the second given density of the suspension configured to be less than the first given density of the supporting liquid; and

adjustment means for adjusting at least one of the first given height of the top surface of the supporting liquid and the second given height of the top surface of the substrate relative to one another so as to transfer the plurality of particles within the suspension from a first position to a second position, wherein the first given height of the top surface of the supporting liquid is higher than the second given height of the top surface of the substrate at the first position and the first given height of the top surface of the fluid is lower than the second given height of the top surface of the substrate at the second position so as to deposit the plurality of particles onto the top surface of the substrate and generate a nanoscale pattern thereon.

2. Apparatus according to claim 1 further comprising a surfactant applicator for selectively

introducing a surfactant onto the top surface of the suspension so as to stimulate organization of a monolayer of the plurality of particles.

3. Apparatus according to claim 2 wherein the substrate is configured for selective vertical adjustment between the top portion and the bottom portion of the container so as to provide the adjustment means for adjusting the second given height of the top surface of the substrate relative to the first given height of the top surface of the supporting liquid so as to lift the monolayer of the plurality of particles off the top surface of the supporting liquid by raising the substrate out of the fluid.

4. Apparatus according to claim 1 further comprising control means for controlling a given surface tension of the plurality of particles within the suspension disposed on the substrate.

5. Apparatus according to claim 1 further comprising an electric field applicator for selectively

applying an electric field to the suspension so as to alter the wetting angle of the suspension so as to promote wetting of the substrate.

6. Apparatus according to claim 1 further comprising a mechanical vibratory force applicator for selectively applying a mechanical vibratory force to the substrate so as to form the plurality of particles into well ordered arrays.

7. Apparatus according to claim 1 further comprising a temperature controller for controlling the temperature of the suspension so as to control the evaporation rate of the suspension fluid.

8. Apparatus according to claim 1 further comprising a magnetic field applicator for applying a magnetic field to the fluid so as to form the plurality of particles into well ordered arrays.

9. Apparatus according to claim 1 further comprising a chemical applicator for applying chemicals

to adjust interaction between particles of the plurality of particles.

10. Apparatus according to claim 1 further comprising a vapor pressure controller for selectively controlling vapor pressure within the container so as to adjust the evaporation rate of the suspension fluid.

11. A method for generating a mask having a nanoscale pattern, the method comprising:

suspending a periodic arrangement of objects on a top surface of a supporting liquid at a first given height above a top surface of a substrate; and

adjusting at least one from a group consisting of the top surface of the supporting liquid and the top surface of the substrate to position the top surface of the supporting liquid below the top surface of the substrate so as to deposit the periodic arrangement of objects onto the top surface of the substrate from the suspension on the top surface of the supporting liquid;

wherein the periodic arrangement of objects is maintained over a given area.

12. A method according to claim 11 wherein the given area is at least one square centimeter.

13. A method according to claim 11 wherein the objects comprise micro-scale particles.

14. A method according to claim 11 wherein the objects comprise nano-scale particles.

15. A method according to claim 14 wherein the nano-scale particles have a diameter within the range of about 10 nanometers to about 5000 nanometers.

16. A method according to claim 11 wherein the objects comprise monodisperse objects with a standard deviation of less than 5% of the particle size.

17. A method according to claim 11 wherein the objects have a generally spherical shape.

18. A method according to claim 11 wherein the objects have a generally cubic shape.

19. A method according to claim 11 wherein the objects have a generally regular shape.

20. A method according to claim 11 wherein the objects comprise multiple sizes of particles.

21. A method according to claim 11 wherein the objects comprises at least one from a group consisting of polystyrene, melamine, polydivinylbenzene, polymethyl methacrylate, poly(styrene-co-divinyl-benzene), poly(styrene-co-methacrylic methylester) copolymers, and silica.

22. A method according to claim 11 wherein the objects comprise organic spherical particles.

23. A method according to claim 11 wherein the organic spherical particles comprise viruses.

24. A method according to claim 11 wherein the substrate comprises an insulator material.

25. A method according to claim 11 wherein the substrate comprises a conductor material.

26. A method according to claim 11 wherein the substrate comprises a semiconductor material.

27. A method according to claim 11 wherein the substrate comprises at least one from a group consisting of glass, silicon, graphite and metal.

28. A method according to claim 11 wherein the substrate comprises a smooth surface having a roughness of less than about 50 nanometers.

29. A method according to claim 11 wherein the substrate comprises a smooth surface having a roughness of less than about 10 nanometers.

30. A method according to claim 11 further comprising the step of treating the substrate to control surface tension of the suspension.

31. A method according to claim 11 further comprising the step of adding a surfactant to the suspension so as to alter a charge of the objects.

32. A method according to claim 31 wherein the surfactant comprises a cationic surfactant.

33. A method according to claim 32 wherein the cationic surfactant comprises sodium dodecyl sulfate ($C_{12}H_{25}NaO_4S$).

34. A method according to claim 31 wherein the surfactant comprises an anionic surfactant.

35. A method according to claim 34 wherein the anionic surfactant comprises a fatty acid amine.

36. A method according to claim 31 wherein the surfactant comprises nonionic surfactants.

37. A method according to claim 36 wherein the nonionic surfactants comprises a polyethylene glycol.

38. A method according to claim 11 further comprising the step of arranging the objects into a monolayer array with a long range order.

39. A method according to claim 11 further comprising the step of arranging the objects into a multilayer array with a long range order.

40. A method according to claim 11 further comprising sequential repetition of the step of suspending the periodic arrangement of objects on the top surface of the supporting liquid at the first given height above the top surface of the substrate and the step of adjusting at least one of the top surface of the supporting liquid and the top surface of the substrate to position the top surface of the supporting

liquid below the top surface of the substrate so as to fabricate multilayer arrays having a controlled orientation of discrete layers.

41. A method according to claim 40 wherein the controlled orientation is determined by optical diffraction.

42. A method for creating a deposition having a nanoscale pattern on a substrate, the method comprising:

suspending a periodic arrangement of objects on a top surface of a supporting liquid at a first given height above a top surface of a substrate;

adjusting at least one from a group consisting of the top surface of the fluid and the top surface of the substrate to position the top surface of the supporting liquid below the top surface of the substrate so as to deposit the periodic arrangement of objects onto the top surface of the substrate from the suspension on the top surface of the fluid, whereby to create a mask; and

depositing a material through interstices contained in the mask so as to create a pattern on the substrate.

43. A method according to claim 42 wherein the step of depositing the material through the interstices contained in the periodic arrangement of objects of the mask comprises one from a group consisting of sputtering, evaporation and spraying of a colloidal solution.

44. A method according to claim 42 wherein the material comprises one from a group consisting of a metal, an insulator, and a semiconductor.

45. A method according to claim 42 wherein the material comprises a catalytic metal for growth of carbon nanotubes.

46. A method according to claim 42 further comprising the step of stripping the mask from the substrate by chemical dissolution in a solvent

subsequent to the step of depositing the material through the intersticies contained in the mask so as to leave the material deposited on the substrate where the interstitial sites previously existed.

47. A method according to claim 46 wherein the solvent is THF.

48. A method according to claim 42 wherein the material precludes carbon nanotube growth.

49. A method according to claim 42 wherein the step of depositing the material through the intersticies contained in the periodic arrangement of the mask comprises depositing a portion of the material above a top surface of the objects, and further comprising the step of dissolving the objects so as to create a freestanding film of material containing perforations corresponding to wherein the interstitial sites previously existed.

50. A method according to claim 42 wherein the pattern on the substrate comprise a hexagonal monolayer structure.

51. A method according to claim 42 wherein the pattern on the substrate comprises a cubic monolayer structure.

52. A method according to claim 42 wherein the pattern on the substrate comprises a multi-dimensional structure.

53. A method according to claim 42 wherein the material deposited on the substrate comprises features having a vertical height less than about 300 nanometers on an edge thereof, and further wherein the material comprises a catalytic material for growth of carbon nanotubes suited to form a single nanotube.